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Iwamoto et al.

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(54) **DIE DEVICE**

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Related U.S. Application Data

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(51) **Int. Cl.**
B26F 1/14 (2006.01)

(52) **U.S. Cl.** **83/686**; 83/698.91

(58) **Field of Classification Search** 83/698.91, 83/686, 684, 697, 699.31, 699.41, 699.51, 83/699.61, 136, 140, 145, 146
See application file for complete search history.

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(57) **ABSTRACT**

When a retainer collar **77** is rotated with respect to a punch guide **29** in a turnable manner, an upper punch driver **49** which pierces the retainer collar **77** so as to be movable up and down is rotated with respect to the punch guide **29**. As a result, since the upper punch driver **49** is screwed into a lower punch driver **37** and is rotated with respect to the lower punch driver **37** provided on the punch guide **29** movablly up and down, an up-down positional relationship between the upper punch driver **49** and the lower punch driver **37** can be adjusted.

7 Claims, 7 Drawing Sheets

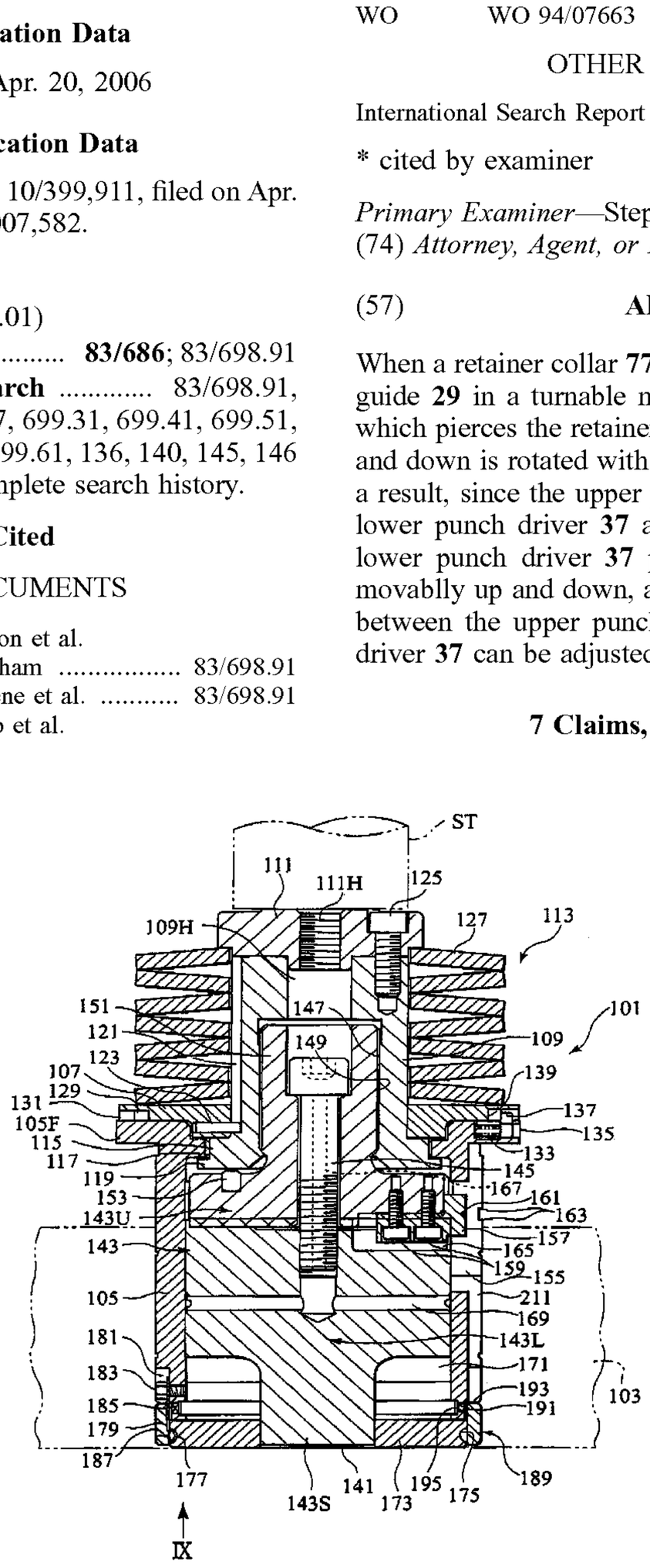

FIG. 1

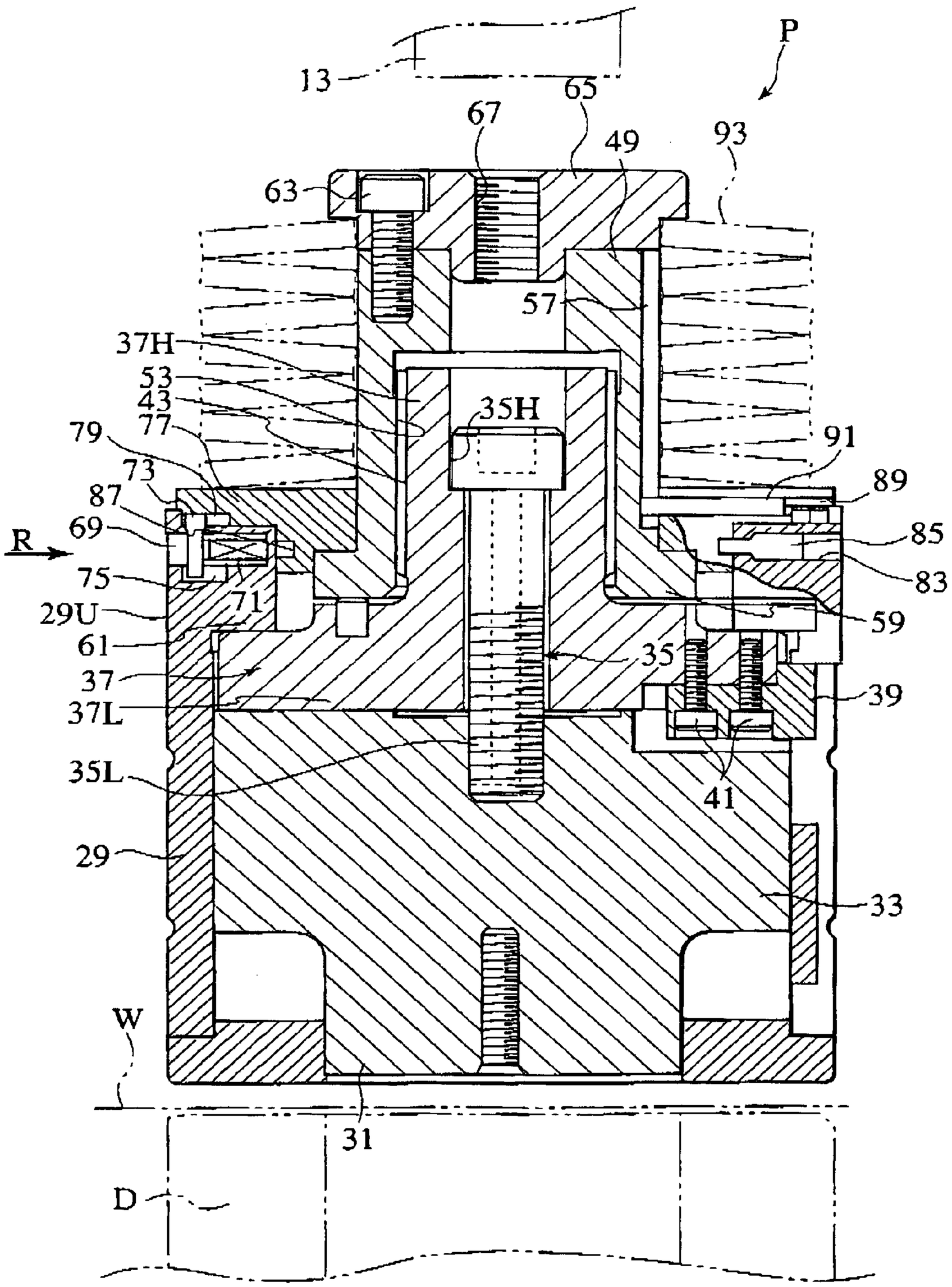
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FIG.2

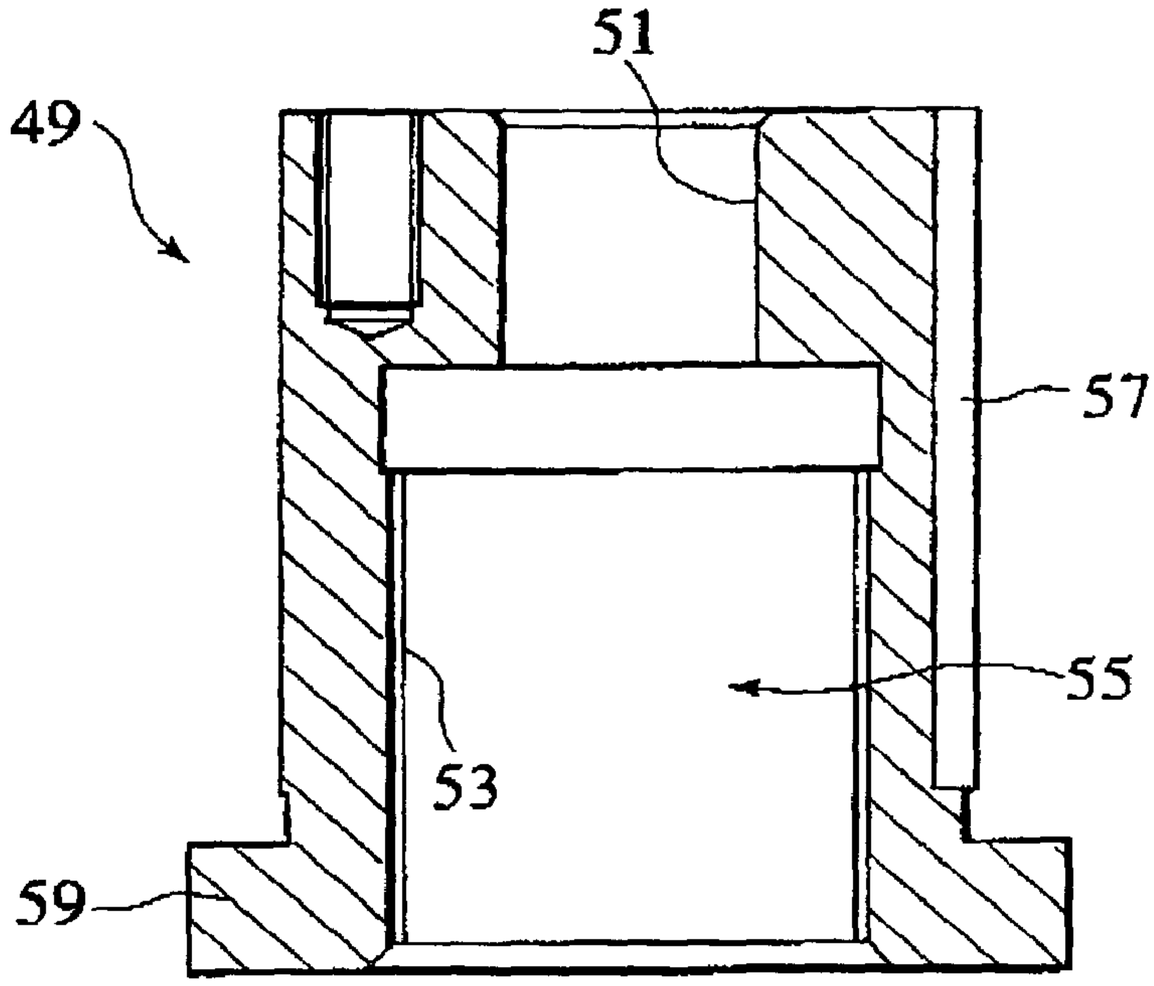


FIG.3

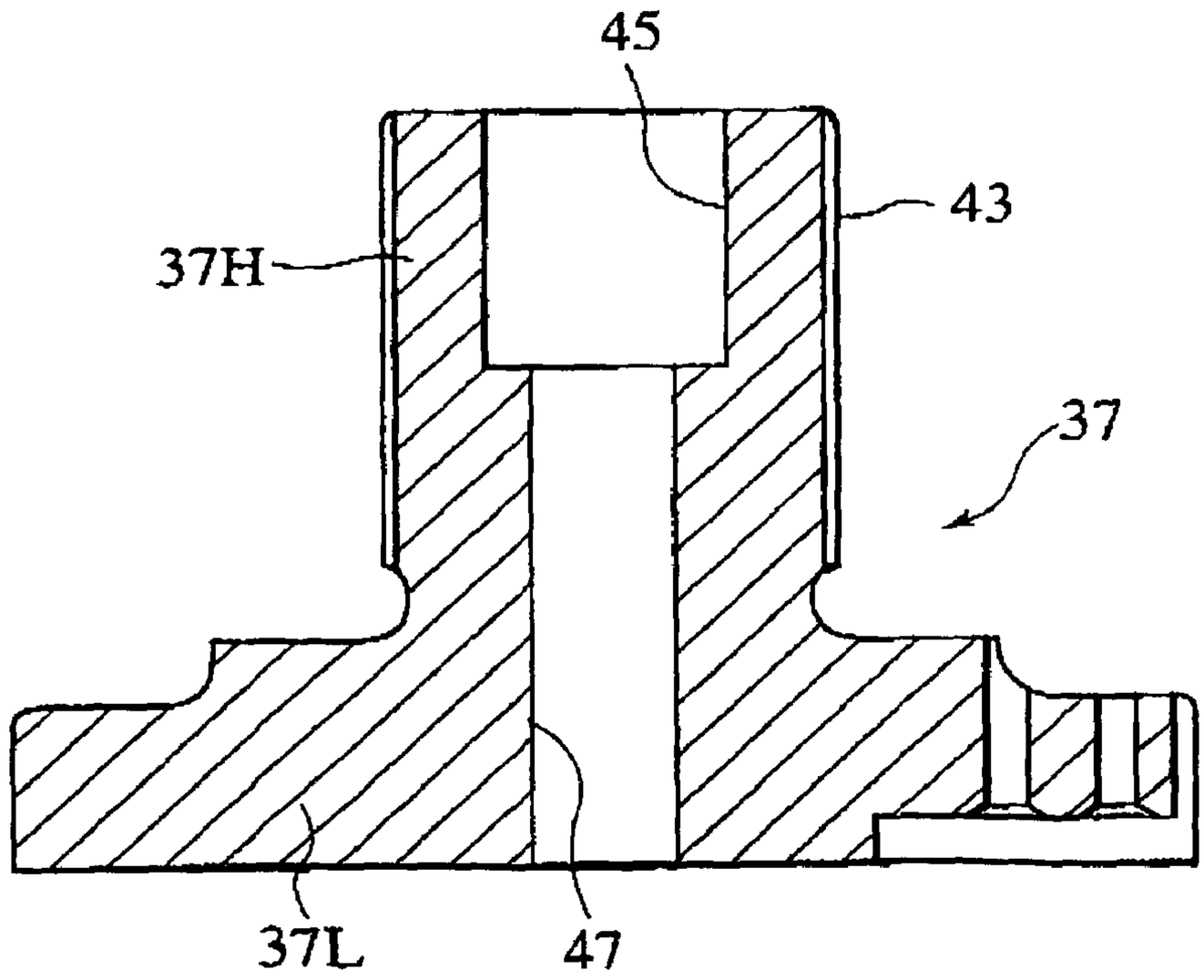
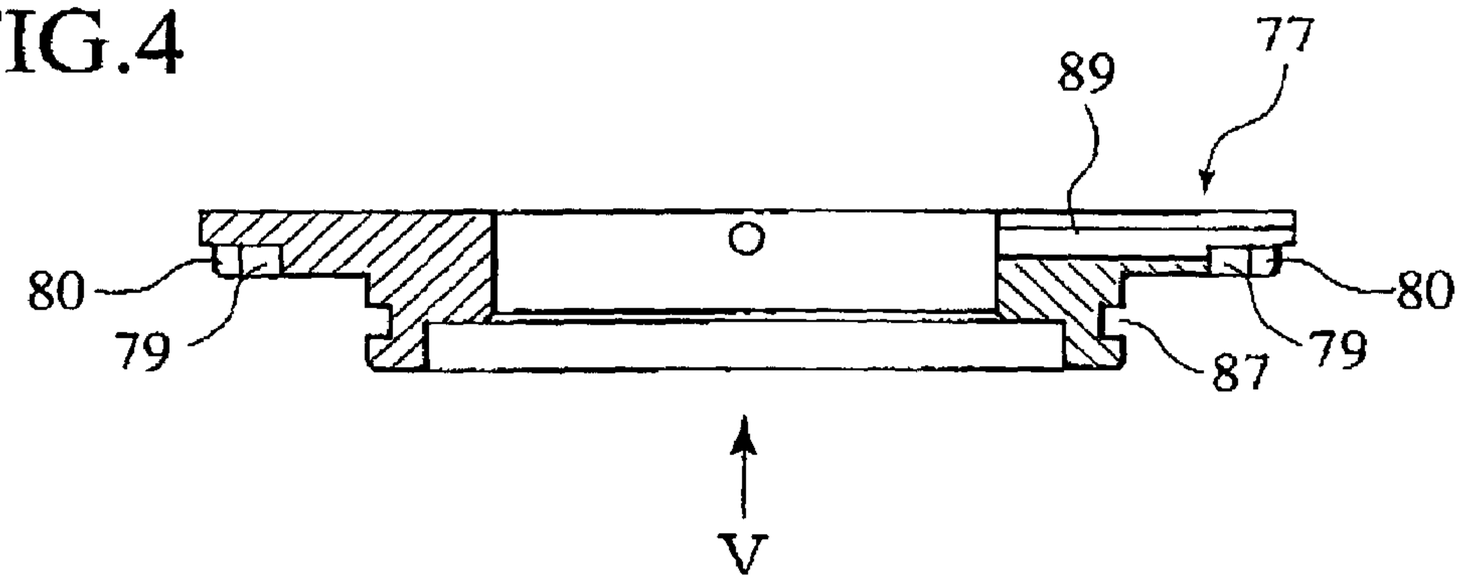


FIG.4



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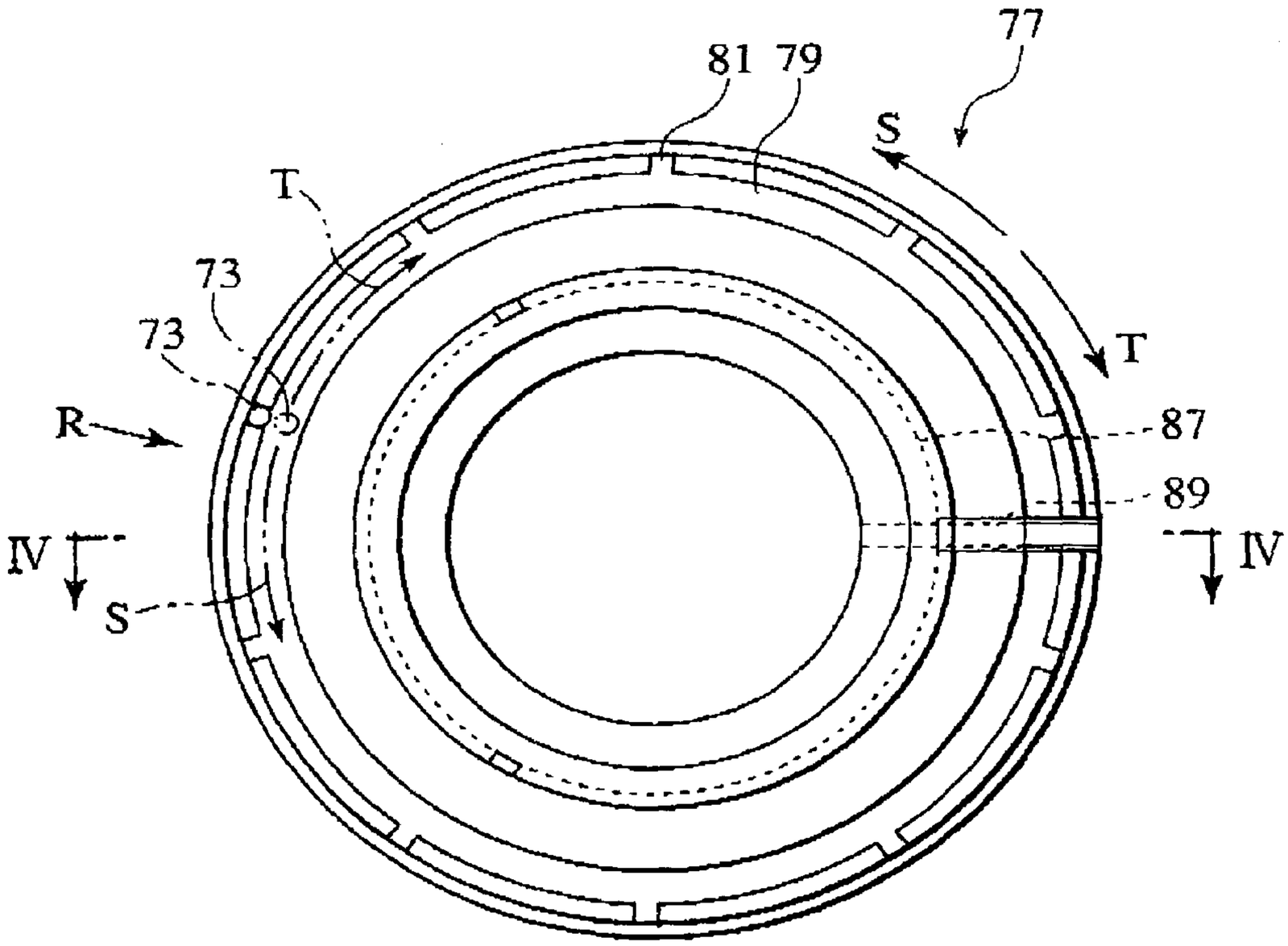

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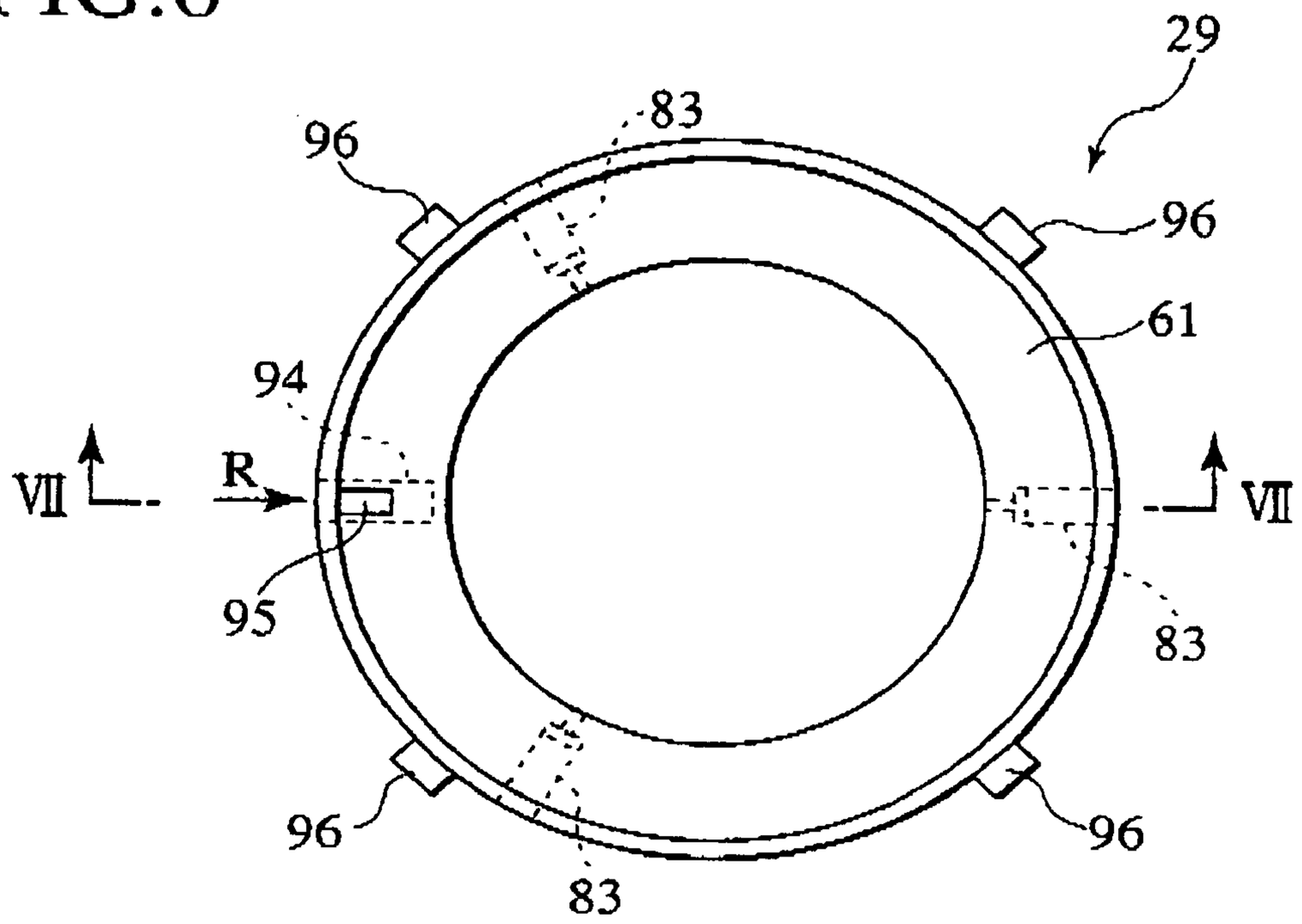

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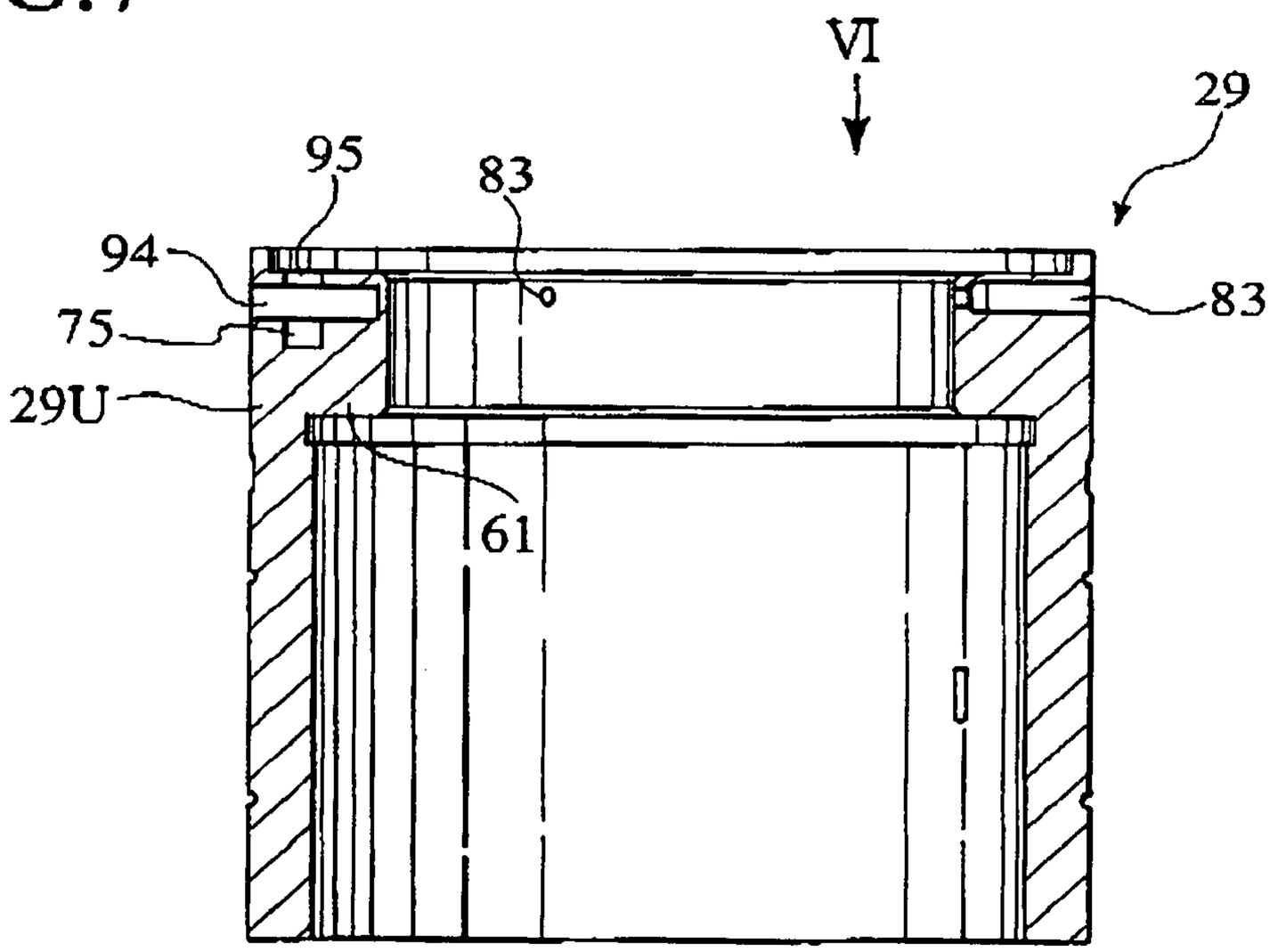

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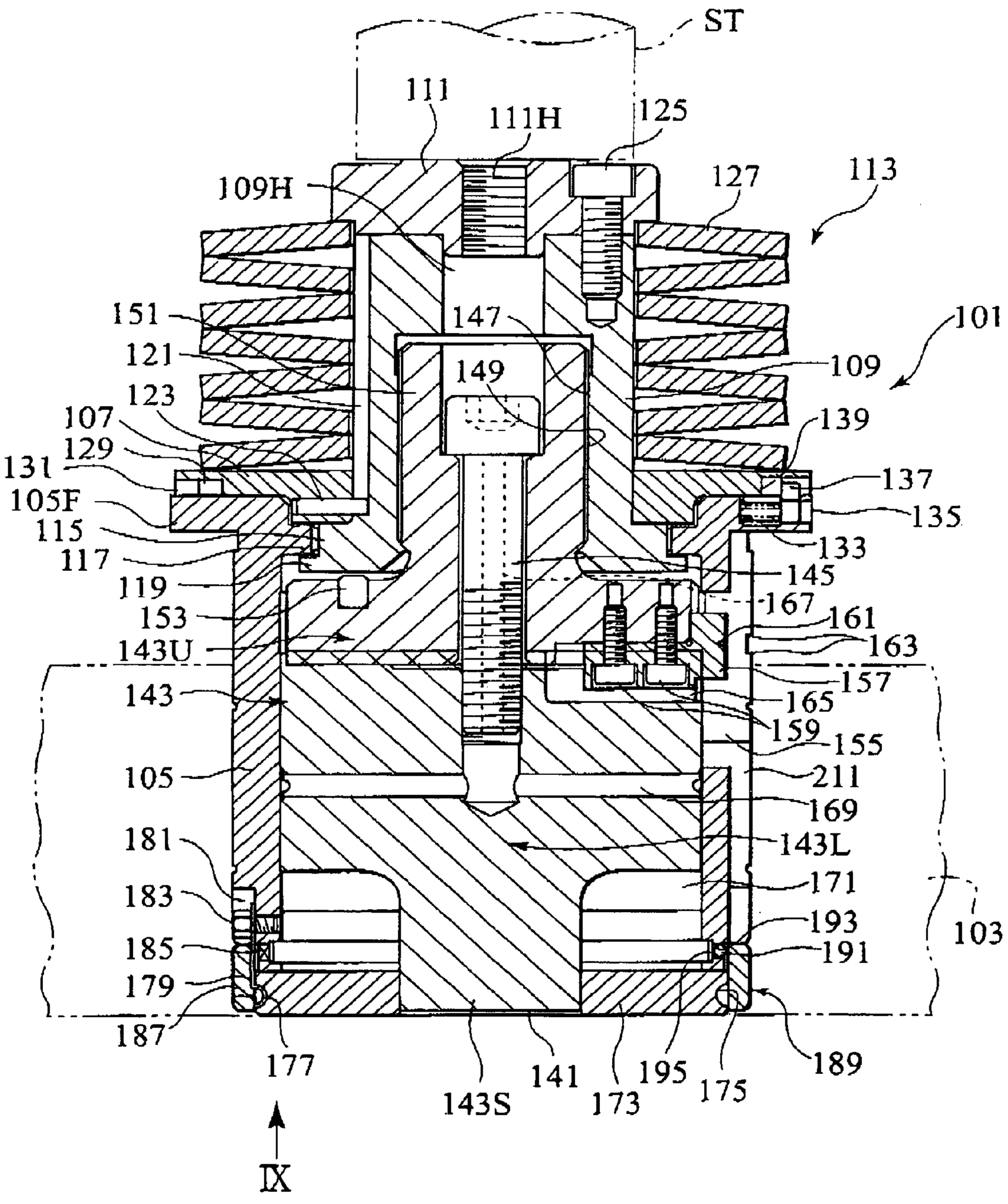
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FIG.9

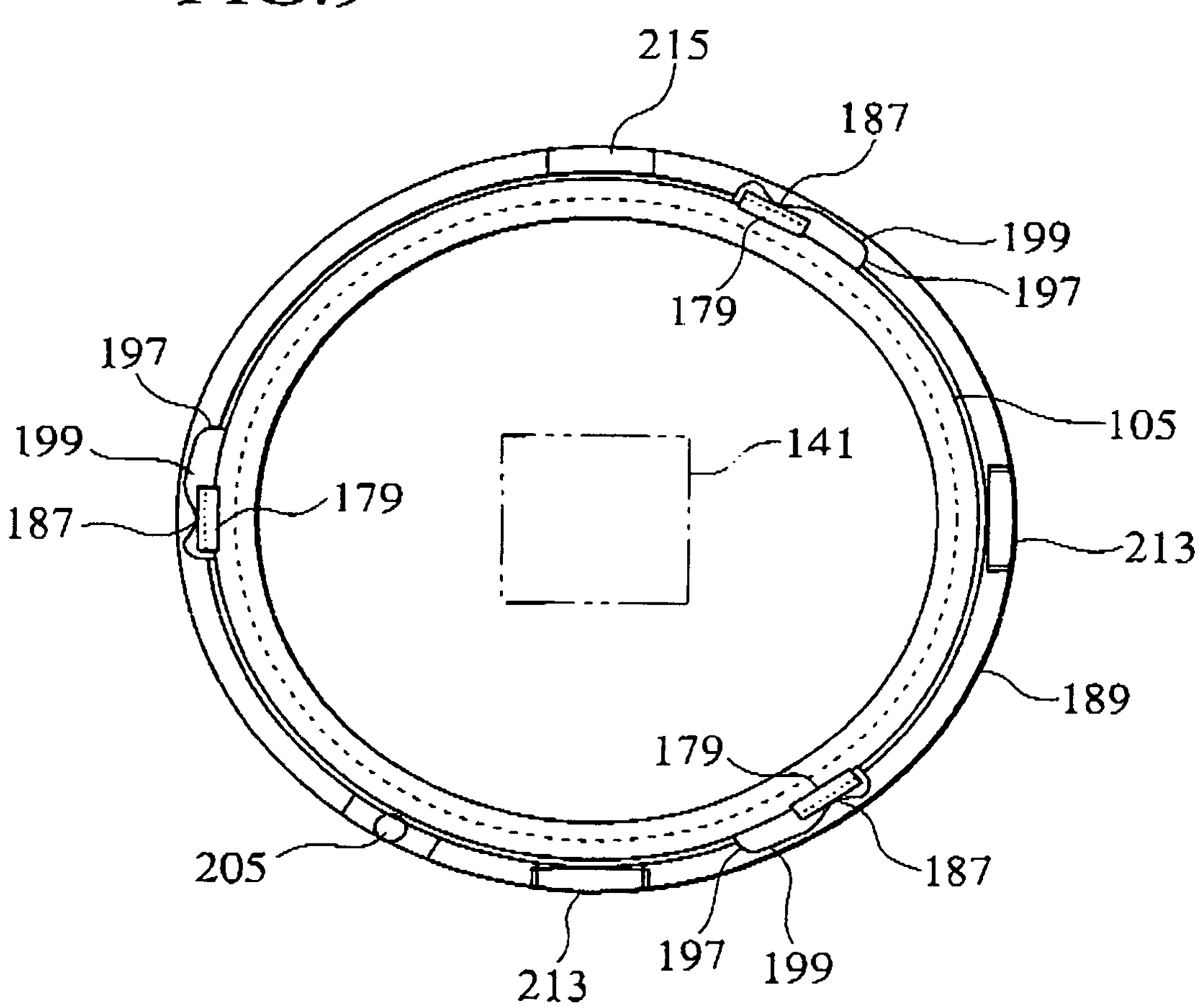
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FIG.10

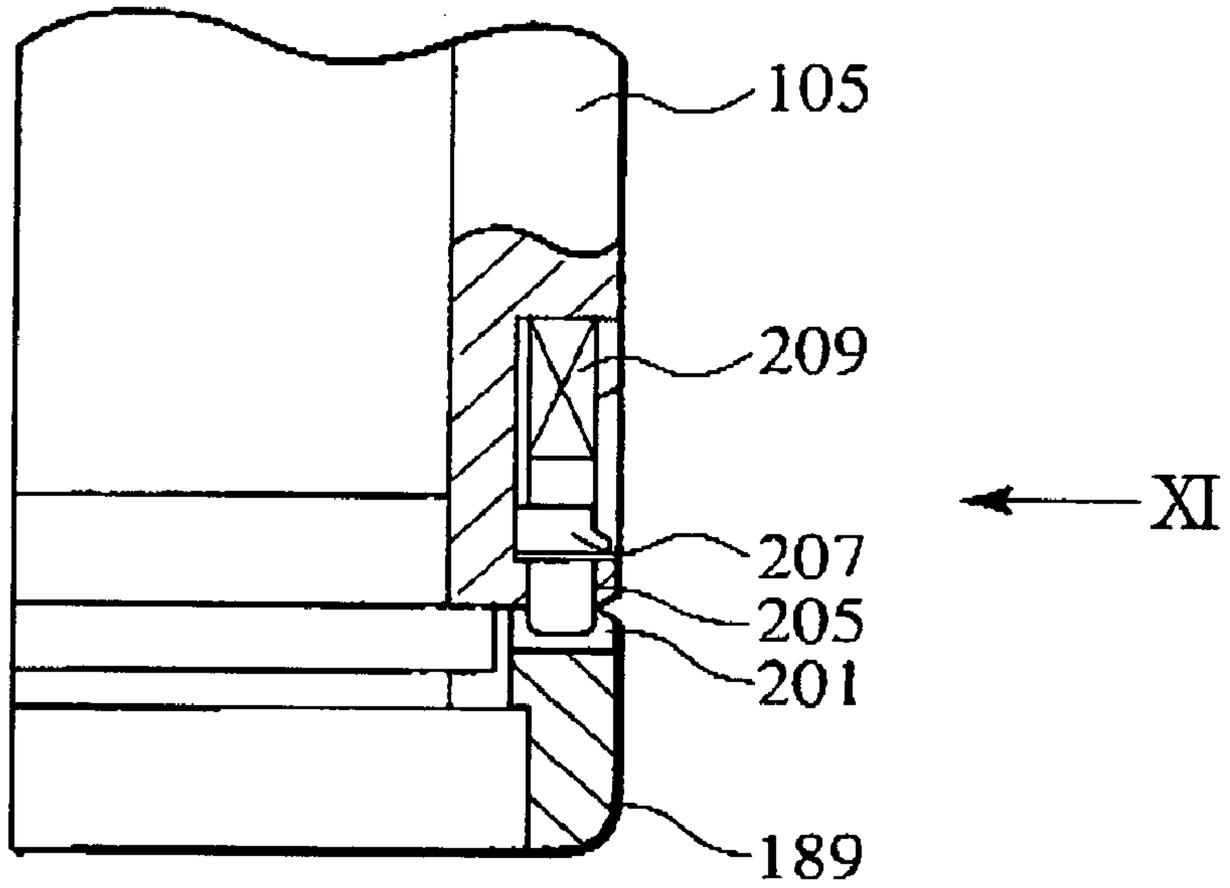
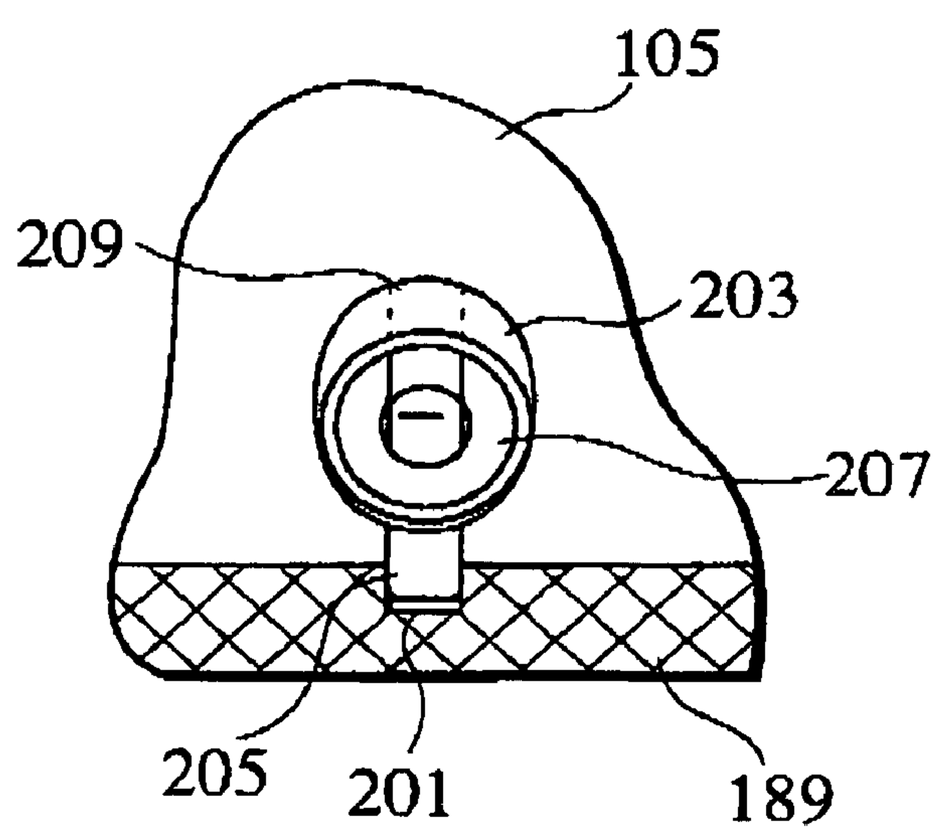


FIG.11



DIE DEVICE

This application is a Division of application Ser. No. 10/399,911 Filed on Apr. 24, 2003, now U.S. Pat. No. 7,007,582 which is hereby incorporated by reference.

TECHNICAL FIELD

The present invention relates to a die device which is attached to a suitable punch press such a s a turret punch press so as to be used. More specifically, the invention relates to the die device, which is configured to have a punch body with a punch blade portion on its lower end is equipped with a punch guide so as to freely move up and down, and a disc-shaped stripper blade encircling the punch blade portion is detachably provided on a lower end of the punch guide and in which attachment/detachment and fixing of the stripper plate are easy and secure and height adjustment after repolishing of the punch blade portion is easy.

BACKGROUND ART

A prior example of the present invention includes Japanese Patent Application Laid-Open No. 10-113725 (1998) (prior example 1) and Japanese Patent Application Laid-Open No. 2000-288656 (prior example 2).

In the prior example 1 (Japanese Patent Application Laid-Open No. 10-113725 (1998)), a punch body having a punch blade portion on Its lower end is provided in a cylindrical punch guide so as to be movable up and down, an oscillation locking piece having a latch portion being freely engaged with an engagement groove formed on an outer peripheral surface of a stripper plate on its lower end is provided on a lower end of the punch guide so as to freely oscillate to an inside-outside direction and be energized to an outside direction, and a turning ring, which has a locking piece pressuring portion for pressuring the oscillation locking piece to an inside direction so that the latch portion of the oscillation locking piece is engaged with the engagement groove of the stripper plate, is turnably provided to the lower end of the punch guide.

In the prior example 1, although the stripper plate can be attached to and detached from the lower end of the punch guide comparatively easily, the oscillation locking piece is made of a plate spring and it is occasionally broken at the attachment portion to the punch guide.

In addition, since the configuration is such that the turning ring is energized to a turning direction by a coil spring so that the latch portion of the oscillation locking piece is maintained to be engaged with the engagement groove of the stripper plate, a further improvement is desired in relation to that the turning ring occasionally turns against an energizing force of the coil spring due to vibration or the like at the time of a punching workpiece.

On the other hand, in the prior example 2 (Japanese Patent Application Laid-Open No. 2000-288656), in a configuration that a punch body having a punch blade portion on its lower end is provided into a cylindrical punch guide so as to be movable up and down, and a disc-shaped stripper plate encircling the punch blade portion is detachably provided to a lower end of the punch guide, a stopper ring is elastically mounted between a ring member fixed to an upper end of a punch driver fitted to an upper portion of the punch guide so as to be movable only up and down and an upper surface of the punch guide, a punch head member having a punch head on its upper end is fitted into the punch driver rotatively, and an external thread portion provided to an upper portion of the punch body is screwed into an internal thread portion provided to the punch head member so that an up-down position is adjustable.

In the above configuration, although the height adjustment after repolishing of the punch blade portion can be made easily, it is difficult to grasp a repolishing quantity of the punch blade portion, and the internal thread portion and the external thread portion are occasionally screwed firmly at the time of assembly after the repolishing. Thus, a further improvement is desired.

The present invention is devised in order to solve the above problems, and its first object is to provide a die device in which the height adjustment after the repolishing of the punch blade portion is easy.

A second object of the present invention is to provide a die device which is capable of attaching/detaching and fixing the stripper plate easily and securely.

DISCLOSURE OF THE INVENTION

In order to achieve the above objects, a die device based on a first aspect of the present invetnion includes: a retainer collar being provided relatively on an upper portion of a punch guide so as to be freely turned and fixed, a lower punch driver connected to a punch body is being fitted and supported into the punch guide so as to freely move up and down; an upper punch driver into which the retainer collar is put so as to freely move up and down; and a lower punch driver, wherein in the above configuration, the upper punch driver and an upper portion of the lower punch driver are screwed into each other in an up-down adjustable manner.

According to the above configuration, when the retainer collar is rotated with respect to the punch guide so as to be turnable with respect to the punch guide, the punch driver pericing through the retainer collar movably up and down is rotated with respect to the punch guide. As a result, since the upper punch driver is screwed into the lower punch driver and the rotates with respect to the lower punch provided on the punch guide movably up and down, the upper punch driver moves up and down with respect to the lower punch driver.

In other words, when the retainer collar freely turns with respect to the punch guide and is rotated with respect to the punch guide, the upper punch driver piercing the retainer collar movably up and down is rotated with respect to the punch guide. As a result, since the upper punch driver is screwed into the lower punch driver and the is rotated with respect to the lower punch driver provided on the punch guide movably up and down, an up-down positional relationship between the upper punch driver and the lower punch driver is changed so that a punch height can be adjusted.

In the die device based on a second aspect depending from the first aspect, an engagement concave portion is provided in a vicinity of an outer peripheral portion of the retainer collar in a peripheral direction; and a latch member, which is maintained so as to be freely engaged with and disengaged from the engagement concave portion and normally in a engaged state, is provided on the upper portion of the punch guide in a diametrical direction so as to freely move.

In the above configuration, in a normal state, the latch member, which is provided on the upper portion of the punch guide movably to the center in the diametrical direction, is engaged with the engagement concave portion provided in the vicinity of the outer peripheral portion of the retainer collar in the peripheral direction, so that the retainer collar cannot rotate with respect to the punch guide. Mean-

while, when the latch member is moved to the inside in the diametrical direction so as to be disengaged from the engagement portion of the retainer collar, the retainer collar is enabled to rotate with respect to the punch guide.

In other words, in the normal state, the latch portion, which is provided on the upper portion of the punch guide movably to the center in the diametrical direction, is engaged with the engagement concave portion provided in the vicinity of the outer peripheral portion of the retainer collar in the peripheral direction, so that the retainer collar is disabled to rotate with respect to the punch guide. Meanwhile, when the punch height is adjusted, the latch member is moved to the inside in the diameterical direction so as to be disengaged from the engagement concave portion of the retainer collar, so that the retainer collar is enabled to rotate with respect to the punch guide. For this reason, when the retainer collar is rotated relatively with respect to the punch guide, the up-down positional relationship between the upper punch driver and the lower punch driver is easily adjusted so that the punch height can be adjusted.

A die device based on a third aspect of the present invention includes: a cylindrical punch guide; a punch body provided in the punch guide so as to freely move up and down, the punch body having a punch blade portion on its lower end; a disc shaped stripper plate detachably provided on a lower end of the punch guide, the disc shaped stripper plate encircling the punch blade portion; an engagement groove formed on an outer peripheral surface of the stripper plate; an oscillation locking piece provided with a latch portion being freely engaged with the engagement groove on its lower end, the engagement groove being provided on a lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided to a lower end of the punch guide rotatively, wherein in the above configuration, a locking member being engaged with an engagement concave portion provided on the turning ring so as to fix the turning ring is provided on the punch guide.

A die device based on a fourth aspect of the present invetnion includes: a cylindrical punch guide; a punch body provided in the punch guide so as to freely move up and down, a punch blade portion being provided on a lower end of the punch body; a disc shaped stripper plate detachably provided on a lower end of the punch guide, the stripper plate encircling the punch blade portion; an engagement groove formed on an outer peripheral surface of the stripper plate; an oscillation locking piece having a latch portion freely engaged with the engaged groove on its lower end, the engagement groove being provided on the lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided on the lower end of the punch guide so as to freely turn, wherein in the above configuration, the oscillation locking piece is loosely supported to a locking piece supporting member provided to the punch guide so as to freely oscillate; and an elastic member for energizing the oscillation locking piece to the outside direction is provided to the locking piece supporting member provided to the punch guide.

In a die device based on a fifth aspect of the present invetnion depending from the third or fourth aspect, the oscillation locking piece is loosely supported to the locking piece supporting member provided to the punch guide so as to freely oscillate; and the elastic member for energizing the oscillation locking piece to the outside direction is provided on the locking piece supporting member provided to the punch guide.

In a die device based on a sixth aspect of the present invetnion depending from one of the third through fifth aspects, an outer periphery surface of the turning ring is provided with a key groove corresponding to a key groove provided on the punch guide; and a takeout groove for removing the stripper plate is provided in a position opposed to the key groove.

In a die device based on a seventh aspect of the present invetnion depending from one of the third through sixth aspects, a plurality of balls for supporting the turning ring in a turnable manner are provided in a plurality of places on the lower end of the punch guide; and a close ring for closing an inside of a ball housing hole housing the balls is provided on a lower end inner peripheral surface of the punch guide.

In a die device based on an eighth aspect depending from one of third through seventh aspects, a key which is engaged with the key groove provided on the punch guide and freely moves up and down is provided on the punch body; and an abrasion amount scale showing an abrasion amount of the punch blade portion based on the up-down position of the key is provided on an outside of the key groove.

A die device based on a ninth aspect includes: a cylindrical punch guide; a punch body provided in the punch guide so a to freely move up and down, the punch body having a punch blade portion on its lower end; and a stripper portion provided on a lower en of the punch guide, the stripper portion encircling the punch blade portion, wherein in the configuration; a punch driver having a punch head on its upper end is provided to be fitted into a retainer collar so as to freely move only up and down, the retainer collar being provided on an upper portion of the punch guide so as to be freely turned and fixed; a strip elastic means for energizing the punch driver to an up direction is provided between the punch head and the retainer collar, a peripheral groove is provided on a lower surface of the retainer collar provided on the upper portion of the punch guide or an upper surface of the punch guide; a plurality of engagement concave portions are provided on an inside or an outside of the peripheral groove in a circumferential direction with suitable gaps; a stopper pin, upper end or lower end of which is freely engaged with the peripheral groove and the engagement concave portion, is provided on the upper portion of the punch guide or a lower portion of the retainer collar so as to freely move to a radiation direction; and the stopper pin is energized so that a state that the upper end or the lower end of the stopper pin is engaged with the engagement concave portion is always maintained.

In a die device based on a tenth aspect depending from the ninth aspect, the punch body is provided so as to be divided into an upper punch body and a lower punch body, the upper and lower punch bodies are provided to be connected integrally by a connecting tool; an external thread portion provide to an upper portion of the upper punch body is provided to be screwed into an internal thread portion formed on the punch driver so that a up-down position is freely adjusted; and a key which is engaged with a key

groove formed on the punch guide is provided on the upper punch body in an up-down position adjustable state.

In a die device based on an eleventh aspect depending from the tenth aspect, an upper surface of the upper punch body or a lower surface of the punch driver is provided with an elastic member for preventing close contact between the upper surface and the lower surface.

In a die device based on a twelfth aspect depending from the tenth or eleventh aspect, the connecting tool which connects the upper and lower punch bodies is composed of a bolt having a fluid passage; and the lower punch body has a guide hole for guiding a fluid supplied via the fluid passage to an outer peripheral surface.

A die device based on a thirteenth aspect includes: a cylindrical punch guide; a punch body provided in the punch guide so as to freely move up and down, the punch body having a punch blade portion on its lower end; a disc shape stripper plate detachably provided on the lower end of the punch guide, the stripper plate encircling the punch blade portion; an engagement groove formed on an outer peripheral surface of the stripper plate; an oscillation locking piece having a latch portion on its lower end so as to be freely engaged with the engagement groove, the engagement groove being provided on the lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided on the lower end of the punch guide so as to freely turn, wherein in the above configuration; a punch driver having a punch head on its upper end is provided to be fitted into a retainer collar so as to freely move only up and down, the retainer collar being provided on an upper portion of the punch guide; the punch driver is provided so as to be energized to the up direction; the punch body is provided so as to be divided into an upper punch body and a lower punch body; the upper and lower punch bodies are provided to be connected integrally by a connecting tool having a fluid passage; an external thread portion provided on an upper portion of the upper punch body is provided to be screwed into an internal thread portion formed on the punch driver so that an up-down position is freely adjusted; the lower punch body is provided with a guide hole for guiding a fluid supplied via the fluid passage to an outer peripheral surface; a plurality of balls for supporting the turning ring in a turnable manner are provided on the lower end of the punch guide; and a close ring for closing an inside of a ball housing hole housing the balls is provided on a lower end inner peripheral surface of the punch guide.

As understood from the explanation of the above configuration, according to the third through thirteenth aspect of the present invention, the stripper plate can be attached and detached easily, and the stripper plate can be fixed to be held securely. Moreover, the repolishing of the punch blade portion and the height adjustment after that are easy, and the above-mentioned conventional problems can be solved.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a sectional view showing a punch die as a die device of the present invention.

FIG. **2** is a sectional view showing an upper punch driver.

FIG. **3** is a sectional view showing a lower punch driver.

FIG. **4** is a sectional view showing a retainer collar.

FIG. **5** is a view in the direction of V in FIG. **4** and a bottom diagram of the retainer collar.

FIG. **6** is a plan view showing a punch guide.

FIG. **7** is a sectional view in the direction of VII—VII in FIG. **6**.

FIG. **8** is a sectional view of the die device based on a second embodiment of the present invention.

FIG. **9** is a bottom view of the die device.

FIG. **10** is partially enlarged sectional view showing a mechanism portion for locking rotation of a turning ring of the die device.

FIG. **11** is a view in the direction of XI in FIG. **10**.

THE BEST MODE FOR CARRYING OUT THE INVENTION

There will be explained below a die device of the present invention as a first embodiment.

FIG. **1** is a sectional view showing a punch die P as the die device of the present invention. The punch die P can be mounted to an upper turret such as a turret punch press, and a punch body **33** having a punch blade portion **31** on its lower end is provided into a punch guide **29** so as to be movable up and down, and a lower punch driver **37** is mounted integrally to an upper side of the punch body **33** by a connecting bolt **35** in a normal state.

Here, a key **39** is mounted to a vicinity of a boundary between the punch body **33** and the lower punch driver **37** by bolts **41**, and the punch body **33** and the lower punch driver **37** are supported integrally to the punch guide **29** so as not to rotate and be movable up and down.

With reference to FIG. **3**, the lower punch driver **37** has a convex portion **37**H, which is provided with a thread portion **43** on its outer peripheral surface, on an upper side of a disc-shaped lower portion **37**L. An upper portion of the convex portion **37**H is provided with a hole **45** into which a head portion **35**H of the connecting bolt **35** is fitted, and the convex portion **37**H and the lower portion **37**L are provided with an inner diameter through hole **47** through which an underhead **35**L of the connecting bolt **35** is put.

With reference to FIGS. **1** and **2**, a cylindrical upper punch driver **49** is provided so as to cover an outside of the convex portion **37**H. An inside of the upper punch driver **49** has a tool hole **51** for inserting a tool for rotating the connecting bolt **35** thereinto, and a space **55** provided with a thread portion **53** on its inner peripheral surface for screwing the convex portion **37**H. Here, an outer peripheral surface of the upper punch driver **49** is provided with a key groove **57** in an up-down direction. Moreover, a lower end of the upper punch driver **49** has a flange portion **59** protruding outward.

Therefore, the upper punch driver **49** is relatively rotated with respect to the lower punch driver **37**, so that an up-down position of the upper punch driver **49** with respect to the lower punch driver **37** can be adjusted by functions of the thread portions **43** and **53**.

With reference to FIG. **1**, the lower portion **37**L of the lower punch driver **37** is supported to an upper end of the punch guide **29** by a retaining portion **61** protruding inward so as to be incapable of ascending and capable of descending.

In addition, as shown in FIG. **6**, four supporting pins **96** are provided to an outside of the upper end of the punch guide **29** so as to protrude. Elastic means such as a coil spring is provided between an upper surface of an upper turret of the turret punch press and the supporting pins **96**, and the punch die P of the present invention is always energized upward.

A punch head **65** is mounted to an upper end surface of the upper punch driver **49** by a connecting bolt **63**. A center of the punch head **65** is provided with a tool inserting hole **67** for rotating the connecting bolt **35**.

Further, there will be explained below a configuration where the up-down position of the upper punch driver **49** with respect to the lower punch driver **37** is adjusted by the functions of the thread portions **43** and **53** of the lower punch driver **37** and the upper punch driver **49**.

The punch guide **29** shown in FIGS. **6** and **7** is in a state before assembly of the punch die P of the present invention. An upper end **29**U of the punch guide **29** is formed with a horizontal hole **94** which extends to a horizontal direction. The horizontal hole **94** is opened to an outer surface of the punch guide **29**. The other end of the horizontal hole **94** does not pierce an inside surface of the retaining portion **61** and is hollow just before the inside surface of the retaining portion **61**.

Further, an approximately center portion of the horizontal hole **94** is formed with another vertical hole **75** which extends to a vertical direction. The horizontal hole **94** and the vertical hole **75** are connected with each other. As shown in FIG. **6**, the vertical hole **75** has an opening **95** on an upper end of the vertical hole **75** so that it upper end is opened to an upper surface of the retaining portion **61**.

The horizontal hole **94** is provided with a push button **69** which is movable to a diametrical direction (a left-right direction in FIG. **1**). The push button **69** is pressured to be energized to an outer direction by an elastic member **71** such as a coil spring. The push button **69** is provided with a stopper pin **73** as a latch member which pierces the push button **69** up and down in a fitted state.

The stopper pin **73** can move to a direction R of the horizontal direction (the left-right direction in FIG. **1**) inside the vertical hole **75**. Further, an upper end of the stopper pin **73** pierces the opening **95** provided to the upper end of the vertical hole **75** upward and protrudes upward from the opening **95**. The stopper pin **73** can move to the direction R inside the vertical hole **75**, but since it abuts against an outside wall of the vertical hole **75** so as not to slip out of the vertical hole **75**.

Next with reference to FIGS. **1**, **4** and **5**, a configuration of a retainer collar **77** mounted into the upper portion of the punch guide **29** will be explained.

Arc shaped convex portions **80** are provided on a lower surface of the retainer collar **77** so as to protrude with equal gaps. In this embodiment, the ten convex portions **80** are formed. Moreover, engagement concave portions **81** are provided between the convex portions **80**. Further, a peripheral groove **79** is provided inside the convex portions **80** on the lower surface of the retainer collar **77**.

In other words, as shown in the drawings, the peripheral groove **79** is formed on the lower surface of the retainer collar **77**, and its peripheral portion is provided with the ten engagement concave portions **81**. When the engagement concave portions **81** and the peripheral groove **79** are formed, as a result the arc shaped convex portions **80** are formed to protrude on the lower surface of the retainer collar **77** with the equal gaps.

With reference to FIG. **4**, the upper end of the stopper pin **73** is provided so as to be engaged with the peripheral groove **79** formed on the lower surface of the retainer collar **77** and a plurality of the engagement concave portions **81** formed on a peripheral direction of the outside of the peripheral groove **79** with a predetermined pitch alternatively. In a normal state as shown in FIG. **1**, the push button **69** is pushed down to the outer direction by the function of the elastic member **71** so that the upper end of the stopper pin **73** is engaged with the engagement concave portion **81**, and a fixed state is obtained in such a manner that rotation of the retainer collar **77** with respect to the punch guide **29** is inhibited.

With reference to FIGS. **1**, **6** and **7**, the retaining portion **61** of the punch guide **29** is provided with three tapped holes **83** which pierce a radial direction with an interval of 120°, and setscrews **85** (see FIG. **1**), for example, are screwed into the tapped holes **83**, respectively, so that the retaining portion **61** is freely engaged with and disengaged from a retaining groove **87** of the retainer collar **77**.

In addition, a through hole **89** which pierces the retainer collar **77** to a diametrical direction is provided (see FIGS. **4** and **5**), and a spring pin **91** (see FIG. **1**) which always protrudes to a center direction is provided on the through hole **89**. Since the spring pin **91** is engaged with a key groove **57** (see FIG. **2**) provided on the outer peripheral surface of the upper punch driver **49** in the up-down direction, the retainer collar **77** integrally rotates with respect to the upper punch driver **49** so as to be movable to the up-down direction.

As shown in FIG. **1**, a stopper spring **93** is provided between the punch head **65** and the retainer collar **77**. Due to repulsion of the stopper spring **93**, the upper punch driver **49** is energized upward via the punch head **65** so as to be disengaged from the retainer collar **77**. However, since the flange portion **59** of the upper punch driver **49** is retained by the retainer collar **77** in an unascendable state, the upper punch driver **49** does not slip off. Namely, the upper punch driver **49** is made to be a unit by a combination of the retainer collar **77**, the stopper spring **93**, the punch head **65** and the connecting bolt **63**. Due to this unit state, as mentioned later, an adjusting operation on punch height of the present invention is easily performed.

In the above configuration, when a striker **13** strikes the punch head **65**, as shown in FIG. **1**, while the stripper spring **93** is being shrank, the punch blade portion **31** is descended via the upper punch driver **49**, the lower punch driver **37** and the punch body **33**, and a punching workpiece is carried out on a workpiecepiece W by a cooperation of the die D.

Next, the punch height adjusting operation will be explained. Firstly in a state that the upper end of the stopper pin **73** protrudes upward from the opening **95** so as to be engaged with the engagement concave portion **81** of the retainer collar **77**, the push button **69** is pushed to the direction R. When the push button **69** is pushed to the direction R against the energizing force of the elastic member **71**, the upper end of the stopper pin **73** is disengaged from the engagement concave portion **81** so as to be located in a position of the inner peripheral groove **79**. Namely, as shown in FIG. **5**, the stopper pin **73** is moved to the direction R to be in a position shown as a stopper pin **73'**.

In this state, the stopper pin **73** can run to a direction S or a direction T in the peripheral groove **74**. Therefore, the punch guide **29** can rotate to the direction S or T. The lower punch driver **37** is in a state that it cannot rotate with respect to the punch guide **29** due to the function of the key **39**, due to the rotation of the punch guide **29** to the direction S or T, the lower punch driver **37** as well as the punch guide **29** integrally rotates to the same direction.

Therefore, the upper punch driver **49** rotates relatively with respect to the lower punch driver **37**, and the lower punch driver **37** moves up and down with respect to the upper punch driver **49** due to the function between the thread portion **53** provided on the inner peripheral surface of the

upper punch driver **49** and the thread portion **43** provided on the convex portion **37**H of the lower punch driver **37**.

For example, in the case where the ten engagement concave portions **81** are provided on the outside of the peripheral groove **79**, when being rotated to an adjacent engagement concave portion **81**, the upper punch driver **49** rotates by 1/10 revolution with respect to the lower punch driver **37**, so that the lower punch driver **37** can be descended by 1/10 of the pitch of the thread portion **53** and the thread portion **43**. Namely, the punch height can be adjusted so as to be higher by 1/10 of the pitch.

Here on the contrary to the above function, in a state that the push button **69** is maintained to be pushed, in other words, in a state that the upper end of the stopper pin **73** is disengaged from the engagement concave portion **81** so as to be located in the position of the inner peripheral groove **79**, rotation of the punch guide **29** and the lower punch driver **37** is fixed, and the upper punch driver **49**, the retainer collar **77**, the stripper spring **93**, the punch head **65** and the connecting bolt **63** which form the unit as mentioned above are rotated to the direction S or T, so that the punch height can be adjusted.

When the up-down adjustment of the lower punch driver **37** with respect to the upper punch driver **49** is made and the pushing of the push button **69** is released, the push button **69** is moved to the outer direction by the energizing force of the elastic member **71**, and the upper end of the stopper pin **73** is engaged with another engagement concave portion **81** so that the relative rotation of the retainer collar **77** is prevented.

From the above result, the push button **69** is pushed to the inner direction and the retainer collar **77** is rotated relatively with respect to the punch guide **29**, so that the punch height can be adjusted easily.

Here, this invention is not limited to the above-mentioned first embodiment of the invention, and the invention can be carried out in another mode by suitable modification. Namely, the above-mentioned embodiment described the case where the ten engagement concave portions **81** are provided with the pitch of 36°, but a number of the engagement concave portions **81** is arbitrary. An adjusting quantity of the punch height can be set by a number of the engagement concave portions **81** and the pitches of the thread portion **53** and the thread portion **43**.

Next, there will be explained below the die device according to a second embodiment of the present invention.

With reference to FIG. **8**, a die device **101** according to the embodiment of the present invention has a cylindrical punch guide **105** which is supported to an upper die holder **103** in a punch press such as a turret punch press (corresponding to an upper turret in the turret punch press) so as to freely move up and down. This punch guide **105** is supported to the upper die holder **103** via a lifter spring (not shown) provided between a flange portion **105**F provided on an upper portion of the punch guide **105** and the upper die holder **103** so as to be movable up and down.

A retainer collar **107** is provided to an upper surface of the punch guide **105** so as to be freely turned and fixed, and a strip elastic means (member) **113** for energizing a punch driver **109** piercing the retainer collar **107** movably only up and down to an upper direction is provided between a punch head **111** mounted to an upper end of the punch driver **109** and the retainer collar **107**.

More specifically, the punch driver **109** pierces the retainer collar **107** from a lower direction so as to be movable up and down, and a lower end of the punch driver **109** is provided with a large diameter portion **115** which freely comes in contact with a lower surface of the retainer collar **107**. A lower portion of the large diameter portion **115** is provided with a lower flange **119**, and the lower flange **119** and the retainer collar **107** loosely nip an annular protruded portion **117** provided on an upper inner peripheral surface of the punch guide **105** to protrude to an inside direction.

The retainer collar **107** and the punch driver **109** integrally rotate, but a key **123** provided on the retainer collar **107** is engaged with a key groove **121** in an up-down direction formed on an outer peripheral surface of the punch driver **109** so that only the punch driver **109** moves up and down. An elastic member **127**, such as a strong belleville spring, coil spring or urethane rubber is elastically mounted as one example of the strip elastic means **113** between the punch head **111** mounted to the upper end of the punch driver **109** via a plurality of bolts **125** and the retainer collar **107**, and the punch driver **109** is always energized to the upper direction.

Here, the retainer collar **107** is provided with a plurality of arc shaped convex portions, engagement concave portions and peripheral grooves similarly to the configuration described in the first embodiment.

As mentioned above, the peripheral groove **129** is formed on the lower surface of the collar retainer **107** so that the collar retainer **107** is supported to the punch guide **105** to be freely turned and fixed, and a plurality of engagement concave portions **131** are provided in a circumferential direction onto an inside or outside of the peripheral groove **129** (in this example, on the outside) with suitable gaps. A guide groove **133** in a radial direction (radiation direction) is formed on an upper surface of the flange portion **105**F in the punch guide **105**, and a stopper pin **137**. which freely moves to a position where its upper end is engaged with the peripheral groove **129** or a position where it is engaged with the engagement concave portion **131**, is mounted to a slide member **135** which is slidably engaged with the guide groove **133**. Moreover, the slide member **135** is energized by an elastic member **139** such as a coil spring mounted into the guide groove **133** so as to be always maintained in a state that the stopper pin **137** is engaged with the engagement concave portion **131**.

In the above configuration, when the slide member **135** is moved against the energizing force of the elastic member, **139** and the stopper pin **137** is moved from the position where it is engaged with the engagement concave portion **131** to the position where it is engaged with the peripheral groove **129**, the retainer collar **107** is turnable with respect to the punch guide **105**.

Therefore, when the retainer collar **107** turns with respect to the punch guide **105**, the punch driver **109** is also turned integrally via the key **123**.

Thereafter, when the movement of the slide member **135** against the energizing force of the elastic member **139** is released, the stopper pin **137** is engaged with another engagement concave portion **131** by the energizing force of the elastic member **139**, so that the retainer collar **107** is fixed into a state where it cannot turn.

Here, since the positions provided with the peripheral groove **129** and the engagement concave portion **131** and the position provided with the stopper pin **171** are relative, the configuration may be such that the peripheral groove **129** and the engagement concave portion **131** are provided on the upper surface of the flange portion **105**F in the punch guide **105**, and the stopper pin **171**, lower end of which is freely engaged with the peripheral groove **129** and the engagement

concave portion **131**, is protruded from the retainer collar **107** to a lower direction and is movable to the radial direction.

A punch body **143** having a punch blade portion **141** on its lower end is fitted into the punch guide **105** so as to freely move up and down. The punch body **143** is divided into an upper punch body **143**U and a lower punch body **143**L, and the upper and lower punch bodies **143**U and **143**L are connected integrally by a connecting tool **145**.

More specifically, a center portion of an upper surface of the upper punch body **143**U is provided with an upward protruded portion **151** protruding to an upper direction, and an external thread portion **149**, which is screwed into an internal thread portion **147** formed on an inner peripheral surface of the punch driver **109** so that its up-down position is freely adjusted, is formed on an outer peripheral surface of the upward protruded portion **151**.

An upper surface of the upper punch body **143**U which is opposed to a lower surface of the punch driver **109** is provided with an elastic member **153** such as urethane rubber for preventing close contact between the lower surface and the upper surface so as to protrude to the up direction. Here, the position provided with the elastic member **153** is relative, and it may be provided to the lower surface of the punch driver **109** so as to protrude to the down direction.

Further, a key **157**, which is engaged with the key groove **155** provided on the punch guide **105** to be movable up an down, is mounted integrally to a lower surface of the punch body **143**U by a plurality of bolts **159**. An outer surface of the key **157** is provided with a mark **161** such as a horizontal line showing the relative up-down position with respect to the punch guide **105**, and an adjustment mark **163** showing an adjusting range of the punch blade portion **141** is provided on an outside of the key groove **155** corresponding to the mark **161**.

Here, in the case where the upper surface or the lower surface of the key **157** is used as a mark, the mark **161** can be omitted, and a relationship between the up-down position of the mark **161** of the key **157** and the position of the adjustment mark **163** is observed, so that an abrasion amount after the reposlishing of the punch blade portion **141** can be grasped. In other words, the adjustment mark **163** performs a function of a kind of abrasion amount scale. Therefore, an abrasion amount or residual polishing allowance of the punch blade portion **141** can be grasped by the positional relationship between the marks **161** and **163**.

In order to agree directivity of the upper punch body **143**U with directivity of the lower punch body **143**L, a key groove **165** which is engaged with the key **157** is formed on the upper surface of the lower punch body **143**L. The lower punch body **143**L having the punch blade portion **141** on its lower end is detachably mounted to the lower portion of the upper punch body **143**U by the connecting tool **145** piercing the upward protruded portion **151** of the punch body **143**U from the upper direction.

The connecting tool **145** is made of a bolt having a fluid passage **167** piercing an axial center portion up and down, and the lower punch body **143**L into which the bolt is screwed is provided with a guide hole **169** for guiding a suitable fluid such as oil mist supplied via the fluid passage **167** to an outer peripheral surface of the lower punch body **143**L.

Therefore, the fluid, which is supplied from a striker ST provided to a punch press (not shown) to be movable up and down via a through holed **111**H of the punch head **111** and a through hole **109**H of the punch driver **109**, is guided to lubricate between the outer peripheral surface of the lower punch body **143**L and the inner peripheral surface of the punch guide **105** via the fluid passage **167** of the connecting tool **145** and the guide holed **169**, and is introduced into an annular compression chamber **171** between a small diameter portion **143**S of the lower punch body **143**L provided to a lower end of the punch blade portion **141** and a lower inner peripheral surface of the punch guide **105**.

A disc shaped stripper plate **173** encircling the punch blade portion **141** is detachably mounted to the lower end of the punch guide **105**. The stripper plate **173** is constituted so that a through hole into which the punch blade portion **141** is fitted is provided to a center portion of the stripper plate **173**, and an engagement groove **175** such as a spherical groove is formed on its outer peripheral surface. In order to detachably support the stripper plate **173** to the lower end of the punch guide **105**, an oscillation locking piece **179**, which has a latch portion **177** being freely engaged with the engagement groove **175** on its lower end, is supported to a plurality of places on a lower end outer peripheral surface of the punch guide **105** so as to freely oscillate.

More specifically, a locking piece supporting member **183** such as a pin or a bolt mounted to a notch **181** formed on a plurality of places on the lower end outer peripheral surface of the punch guide **105** is loosely fitted into a hole provided on an upper portion of the oscillation locking piece **179**, so that the oscillation locking piece **179** is supported in a radial direction (inside-outside direction) so as to be capable of oscillating, and is energized to the outside direction by an elastic member **185** such as a coil spring which intervenes between the oscillation locking piece **179** and the lower end of the punch guide **105**. Namely, the oscillation locking piece **179** is supported in a state that it is not fastened nor fixed integrally to the punch guide **105** by the locking piece supporting member **183** but is suspended loosely.

In order to maintain a state that the latch portion **177** on the lower end of the oscillation locking piece **179** is engaged with the engagement groove **175** of the stripper plate **173**, a turning ring **189**, which has a locking piece pressuring portion **187** (see FIG. **9**) for pressuring the oscillation locking piece **179** to the inside direction against the energizing force of the elastic member **185**, is mounted to the lower end outer peripheral surface of the punch guide **105** so as to be freely turned and fixed.

Here, in order to facilitate the rotation of the turning ring **189** with a hand so that the stripper can be replaced without using a tool, as shown in FIG. **11**, knurl workpieceing is performed oh the outer peripheral surface of the turning ring **189**.

On the other hand, a ball housing hole **193** which houses a ball **191** (see FIG. **8**) rotatively is formed on a plurality of places on the lower end of the punch guide **105**, a part of the ball **191** is protruded from the ball housing hole **193** to the outside direction and is brought into contact with an inner peripheral surface of the turning ring **189**, so that the turning ring **189** is supported so as to be turnable. In order to prevent slipplng-off of the ball **191** from the ball housing hole **193** to the inside direction and close an inside of the ball housing hole **193**, a closing ring **195** is engaged with the peripheral groove formed on the lower end inner peripheral surface of the punch guide **105** correspondingly to the ball housing hole **193**.

Here, the ball housing hole **193** does not pierce up to the inner peripheral surface of the punch guide **105** and a punching workplace is stopped just before the inner peripheral surface, so that the configuration can be modified into a configuration for preventing the slipping-off of the ball **191**

can be provided. In this case, the closing ring **195** is not necessary, so that the configuration can be simplified.

A notched concave portion **197** (see FIG. **9**), inside of which is opened, is formed in a position of the turning ring **189** corresponding to the oscillation locking piece **179**, and the locking piece pressuring portion **187** is formed on the notched concave portion **197** so as to protrude to the inside direction, and a pressuring releasing portion **199** for releasing the pressure of the oscillation locking piece **179** to the inside direction is formed so as to be adjacent to the locking piece pressuring portion **187**.

Therefore, as shown in FIG. **9**, in the state that the locking piece pressuring portion **187** abuts against the oscillation locking piece **179**, the oscillation locking piece **179** is pressured to the inside direction, and the latch portion **177** of the oscillation locking piece **179** is engaged with the engagement groove **177** of the stripper plate **173**. Further, when the turning ring **189** is turned to a counterclockwise direction in FIG. **9** and the pressurizing releasing portion **199** corresponds to the oscillation locking piece **179**, the pressuring of the oscillation locking piece **179** is released, so that the stripper plate **173** is enabled to be attached and detached.

In order to bring the turning ring **189** into a fixed state, an engagement concave portion **201** is formed on a suitable position on the upper portion of the turning ring **189** as shown in FIGS. **10** and **11**, and a locking member **207**, which has an engagement member **205** freely engaged with the engagement concave portion **201** on its lower portion, is provided in a concave portion **203** formed on the outer peripheral surface of the punch guide **105** so as to be movable up and down and is always energized to the down direction by an elastic member **209** such as a coil spring.

The state that the engagement member **205** is engaged with the engagement concave portion **201** of the turning ring **189** is the state such that the locking piece pressuring portion **187** pressures the oscillation locking piece **179** to the inside direction, namely, the unturnable state.

Incidentally, a key (not shown) for holding directivity of the die device **101** constant is provided to the upper die holder **103**, a key groove **211** (see FIG. **8**) which is freely engaged with and disengaged from the key is formed on the outer peripheral surface of the punch guide **105**, and a key groove **213** (see FIG. **9**) is formed on a position where the turning ring **189** corresponds to the key groove **211**. Moreover, a takeout groove **215** such as a notched portion for dismounting the stripper plate **173** from the lower end of the punch guide **105** is formed on a position opposed to the key groove **123**.

With the above configuration, similarly to the normal die device, when the die device **101** is attached to the upper die holder **103** in the punch press so as to be movable up and down and the punch head **111** is struck by the striker ST provided to the punch press movably up and down, the entire die device **101** is descended with respect to the upper die holder **103** against the lifter spring (not shown), and the stripper plate **173** provided to the lower portion comes in contact with a plate shaped workpiece (not shown) to be punched so that the workpiece is pressured to be fixed to a die (not shown) as a lower die.

Thereafter, when the striker ST is further descended, the punch head **111**, the punch driver **109** and the upper and lower punch bodies **143**U and **143**L are integrally descended with respected to the punch guide **105** against the energizing force of the strip elastic means **113**, so that the workpiece is punched by the punch blade portion **141** in cooperation of the die.

As mentioned above, when the punch head **11** is struck and descended by the striker ST, after a fluid of a lubricant such as oil mist is ejected and supplied in an atomized manner from a fluid supply port (not shown) provided on the striker ST to the through hole **111**H of the punch head **111**, the pressure fluid passes through the fluid passage **167** of the connecting tool **145** and the guide hole **169** of the lower punch body **143**L and reaches to lubricate between the outer peripheral surface of the lower punch body **143**L and the inner peripheral surface of the punch guide **105**, and flows into the annular compression chamber **171**.

When the punch body **143** is descended with respect to the punch guide **105**, the fluid in the compression chamber **171** is compressed, and simultaneously when the workpiece is punched by the punch blade portion **141**, the fluid is ejected from a minute gap between the circumference of the punch blade portion **141** and the inner peripheral surface of the through hole of the stripper plate **173** to the down direction, and blank or scrap in the die is ejected to be discharged to the down direction.

As mentioned above, when the fluid in the annular compression chamber **171** is compressed, it tends to be ejected from the ball housing hole **193** to the outside, but since the ball housing hole **193** is closed by the close ring **195**, the fluid can be prevented from being ejected from the ball housing hole **193**, so that the fluid can be compressed effectively in the compression chamber **171**.

In the case where the punch blade portion **141** is abraded and needs to be repolished, in the state that the die device **101** is removed from the upper die holder **103**, the stripper plate **173** is removed and the lower punch body **143**L is removed so that the punch blade portion **141** is repolished.

In order to remove the stripper plate **173** from the lower end portion of the punch guide **105**, in FIGS. **10** and **11**, the locking member **207** is moved to the up direction against the elastic member **209**, and the engagement member **205** is disengaged from the engagement concave portion **201** of the turning ring **189**. When the turning ring **189** is turned to the counterclockwise direction in FIG. **9** and the pressuring of the oscillation locking piece **179** to the inside direction by means of the locking piece pressuring portion **187** is released, the oscillation locking piece **179** is moved to the outside direction by the function of the elastic member **185**, and the latch portion **177** of the oscillation locking piece **179** is disengaged from the engagement groove **175** of the stripper plate **173** so that the fixing of the stripper plate **173** is released.

Thereafter, a finger is put into the takeout groove **215** of the turning ring **189** and holds the stripper plate **173**, so that the stripper plate **173** can be removed from the lower end portion of the punch guide **105**.

After the stripper plate **173** is removed from the punch guide **105** as mentioned above, a suitable tool is put into the through holes **111**H and **109**H of the punch head **111** and the punch driver **109**, and the connecting tool **145** is turned to be loosened, so that the lower punch body **143**L can be removed from the upper punch body **143**U to the down direction. After the lower punch body **143**L is removed in such a manner and the punch blade portion **141** is repolished, the punch blade portion **141** is put into the punch guide **105** from below, and the upper surface of the lower punch body **143**L is brought into contact with the lower surface of the upper punch body **143**U and the connecting tool **145** is tightened, so that the upper and lower punch bodies **143**U and **143**L can be fixed integrally.

Thereafter, the slide member **135** is moved against the elastic member **139**, and when the punch driver **109** is turned

via the punch head **111** in the state that the stopper pin **137** is located in the peripheral groove **129** of the retainer collar **107**, the external thread portion **149** of the upper punch body **143**U, which is screwed into the internal thread portion **147** of the punch driver **109**, relatively turns, and the upper and lower punch bodies **143**U and **143**L move up and down relatively with respect to the punch driver **109**, so that the height is adjusted. Namely, the punch body **143** is adjusted to be descended by an amount corresponding to a re-polishing amount of the punch blade portion **141**.

Here, when the positional relationship between the mark **161** of the key **157** and the adjustment mark **163** provided on the outside of the key groove **155** is observed, a total re-polishing amount of the punch blade portion **141** can be grasped, so that a state can be grasped as to whether the punch blade portion **141** allows of re-polishing, namely, whether the lower punch body **143**L reaches a life that it should be replaced.

As mentioned above, after the lower punch body **143**L is mounted integrally to the lower portion of the upper punch body **143**U, the stripper plate **173** is mounted to the lower end of the punch guide **105**, and when the turning ring **189** is turned to the clockwise direction and the oscillation locking piece **179** is pressured to the inside direction by the locking piece pressuring portion **187** as shown in FIG. **9**, the latch portion **177** of the oscillation locking piece **179** is engaged with the engagement groove **175** of the stripper plate **173** so that the stripper plate **173** is fixed.

Thereafter, as shown in FIGS. **10** and **11**, when the engagement member **205** is engaged with the engagement concave portion **201** of the turning ring **189**, the turning ring **189** is fixed in the unturnable manner to be brought into an initial state, and the turning of the turning ring **189** is inhibited due to oscillation or the like at the punching workpiece, so that the fixed state of the stripper plate **173** is maintained.

Incidentally, when the oscillation locking piece **179** is pressured and oscillated in and out as mentioned above, since the oscillation locking piece **179** is loosely supported to the locking piece supporting member **183** so as to freely oscillate, bending does not occur on the oscillation locking piece **179**, and thus the oscillation locking piece **179** is not broken even due to long-time use.

In addition, in the case where the punch driver **109** is turned with respect to the upper punch body **143**U as mentioned above so that the up-down position of the upper punch body **143**U is adjusted relatively, when the lower surface of the punch driver **109** approaches the upper surface of the upper punch body **143**U, the elastic member **153** is compressed and resistance becomes large. For this reason it can be grasped that the lower surface approaches the upper surface, and it can be previously prevented that the lower surface and the upper surface come in close contact with each other and the internal thread portion **147** and the external thread portion **149** are tightened firmly.

In addition, in the above configuration, as for a change in a shape of the punch blade portion **141**, the other part of the configuration can be common by replacing the lower punch body **143**L and the stripper plate **173** so that the common parts can be standardized, and even in the case where the shape of the punch blade portion is various, it can be manufactured easily and quickly.

The invention claimed is:

1. A die device comprising:

a cylindrical punch guide;

a punch body provided in the punch guide so as to freely move up and down, the punch body having a punch blade portion on its lower end;

a disc shaped stripper plate detachably provided on a lower end of the punch guide, the disc shaped stripper plate encircling the punch blade portion;

an engagement groove formed on an outer peripheral surface of the stripper plate;

an oscillation locking piece provided with a latch portion being freely engaged with the engagement groove on its lower end, the oscillation locking piece being provided on a lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and

a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided to a lower end of the punch guide rotatively,

wherein in the above configuration, a locking member being engaged with an engagement concave portion provided on the turning ring so as to fix the turning ring is provided on the punch guide.

2. The die device according to claim **1**, wherein:

the oscillation locking piece is loosely supported to a locking piece supporting member provided to the punch guide so as to freely oscillate; and

an elastic member for energizing the oscillation locking piece to the outside direction is provided on the locking piece supporting member provided to the punch guide.

3. The die device according to claim **2**, wherein:

an outer periphery surface of the turning ring is provided with a key groove corresponding to a key groove provided on the punch guide, and

a takeout groove for removing the stripper plate is provided in a position opposed to the key groove.

4. The die device according to claim **3**, wherein:

a plurality of balls for supporting the turning ring in a turnable manner are provided in a plurality of places on the lower end of the punch guide, and

a close ring for closing an inside of a ball housing hole housing the balls is provided on a lower end inner peripheral surface of the punch guide.

5. The die device according to claim **4**, wherein:

a key which is engaged with the key groove provided on the punch guide and freely moves up and down is provided on the punch body; and

an abrasion amount scale showing an abrasion amount of the punch blade portion based on the up-down position of the key is provided on an outside of the key groove.

6. A die device comprising:

a cylindrical punch guide;

a punch body provided in the punch guide so as to freely move up and down, a punch blade portion being provided on a lower end of the punch body;

a disc shaped stripper plate detachably provided on a lower end of the punch guide, the stripper plate encircling the punch blade portion;

an engagement groove formed on an outer peripheral surface of the stripper plate;

an oscillation locking piece having a latch portion freely engaged with the engagement groove on its lower end, the oscillation locking piece being provided on the

lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and

a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided on the lower end of the punch guide so as to freely turn,

wherein in the above configuration, the oscillation locking piece is loosely supported to a locking piece supporting member provided to the punch guide so as to freely oscillate; and

wherein an elastic member for energizing the oscillation locking piece to the outside direction is provided to the locking piece supporting member provided to the punch guide.

7. A die device comprising:

a cylindrical punch guide;

a punch body provided in the punch guide so as to freely move up and down, the punch body having a punch blade portion on its lower end;

a disc shape stripper plate detachably provided on the lower end of the punch guide, the stripper plate encircling the punch blade portion;

an engagement groove formed on an outer peripheral surface of the stripper plate;

an oscillation locking piece having a latch portion on its lower end so as to be freely engaged with the engagement groove, the oscillation locking piece being provided on the lower end of the punch guide so as to freely oscillate to an inside-outside direction and being energized to the outside direction; and

a turning ring having a locking piece pressuring portion for pressuring the oscillation locking piece to the inside direction against the energizing force in order to engage the latch portion of the oscillation locking piece with the engagement groove of the stripper plate, the turning ring being provided on the lower end of the punch guide so as to freely turn,

wherein in the above configuration:

a punch driver having a punch head on its upper end is provided to be fitted into a retainer collar so as to freely move only up and down, the retainer collar being provided on an upper portion of the punch guide;

the punch driver is provided so as to be energized to the up direction;

the punch body is provided so as to be divided into an upper punch body and a lower punch body;

the upper and lower punch bodies are provided to be connected integrally by a connecting tool having a fluid passage;

an external thread portion provided on an upper portion of the upper punch body is provided to be screwed into an internal thread portion formed on the punch driver so that an up-down position is freely adjusted;

the lower punch body is provided with a guide hole for guiding a fluid supplied via the fluid passage to an outer peripheral surface;

a plurality of balls for supporting the turning ring in a turnable manner are provided on the lower end of the punch guide; and

a close ring for closing an inside of a ball housing hole housing the balls is provided on a lower end inner peripheral surface of the punch guide.

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